Conservation Assessment for *Polemonium occidentale v. lacustre* Western Jacob's Ladder

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September 2003

This Conservation Assessment/Approach was prepared to compile the published and unpublished information on the subject taxon or community; or this document was prepared by another organization and provides information to serve as a Conservation Assessment for the Eastern Region of the Forest Service. It does not represent a management decision by the US Forest Service. Though the best scientific information available was used and subject experts were consulted in preparation of this document, it is expected that new information will arise. In the spirit of continuous learning and adaptive management, if you have information that will assist in conserving the subject taxon, please contact the Eastern Region of the Forest Service Threatened and Endangered Species Program at 310 Wisconsin Avenue, Suite 580 Milwaukee, Wisconsin 53203.

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EXECUTIVE SUMMARY

This Conservation Assessment provides information pertaining to the life history, habitat, distribution and abundance, potential threats, future research and monitoring needs for Western Jacob's Ladder (*Polemonium occidentale* v. *lacustre*). The name "lacustre" refers to the fact that this subspecies is found only in wetland habitat (Dictionary of Botanical Epithets -DBE).

This single stemmed phlox produces bright violet flowers in late June or early July. In general, *Polemonium* species are easily recognized by their ladder-like leaf structure. This rare subspecies can reproduce vegetatively as well as through seed production. Little is known about the ecology of this species.

Preferred habitat for *Polemonium occidentale spp. lacustre* is openings, either natural or human-created, in conifer swamps that are typically dominated by northern white cedar. All of the known locations have a near-neutral pH and water chemistry that indicates ground water upwelling.

Polemonium occidentale v. *lacustre* is an endangered species only found in three counties in the Great Lakes region: St. Louis and Itasca Counties in Minnesota and Florence County in Wisconsin. This species is designated as a Regional Forester Sensitive Species on the Chequamegon-Nicolet and Superior National Forests and populations exist on both forests.

Threats to this species relate to the habitat requirements for this species.
Data suggests that this species requires open forested wetland communities with associated white cedar. Likely threats would be related to increased canopy closure and any activity that directly alters the habitat and destroys plants, including peat mining, flooding by beaver dams, lack of cedar viability due to deer herbivory.

ACKNOWLEDGEMENTS

PLANTS' vascular plant nomenclature, most phytogeography, and core attribute data for the United States and its Caribbean territories are provided under a cooperative agreement with John Kartesz and his staff at the Biota of North America Program (BONAP).

Data Acquisition– I appreciate the cooperative effort from the following organizations and individuals:

- Department of Natural Resources Ecological Services - Steve Wilson
- Wisconsin Biomapper
- Wisconsin Department of Natural Resources Natural Heritage Inventory
- University of Minnesota – J. F. Bell Museum of Natural History Herbarium
- Linda Parker, Forest Ecologist Chequamegon-Nicolet National Forest
- Jack Greenlee, Forest Plant Ecologist, Superior National Forest (also provided Chippewa National Forest data)
- Craig Anderson, Wisconsin DNR – Bureau of Endangered Resources
- Sharon Nelson, Minnesota Heritage Program/MN County Biological Survey
- Carmen Converse, Minnesota Heritage Program/MN County Biological Survey
- Anita F. Cholewa, Bell Museum of Natural History-University of Minnesota
- Vermilion Community College Document Delivery Service
- Steven Spickerman, Chequamegon-Nicolet National Forest
- Gary Fewless, Cofrin Center for Biodiversity, U of Wisconsin – Green Bay

NOMENCLATURE AND TAXONOMY

Kingdom	- Plantae – Plants
Subkingdom	- Tracheobionta – Vascular plants
Superdivision	- Spermatophyta – Seed plants
Division	- Magnoliophyta – Flowering plants
Class	- Magnoliopsida – Dicotyledons
Subclass	- Asteridae
Order	- Solanales –
Family	- Polemoniaceae – Phlox family
Genus	- Polemonium L. – Jacob's-ladder
Species	- Polemonium occidentale Greene – western polemonium
Subspecies	- Polemonium occidentale Greene ssp. lacustre Wherry (western polemonium)
USDA symbol:	- POOCL
Plant Synonyms:	- POOCL2 Polemonium occidentale Greene var. lacustre (Wherry) Lakela

Description of Species

The Natural Resource Conservation Service Plant Database lists 14 genera in *Polemoniaceae,* 22 species in *Polemonium* in North America and 2 subspecies in *Polemonium occidentale*:

- *Polemonium occidentale* ssp. *occidentale* Greene
- *Polemonium occidentale* v. *lacustre* (Wherry) Lakela

The name "lacustre" refers to the fact that this subspecies is found only in wetland habitat. The name is derived from the Latin “lacus” (stem Lac) a noun meaning lake, pond or pool and the Latin “ustris” (stem ustr) an adjective suffix for nouns inferring origin or habitat. (DBE).

Olga Lakela first discovered Polemonium occidentale v. lacustre in 1937 in St. Louis County. (Minnesota Bell Herbarium records- Appendix 2)

Polemonium occidentale ssp. lacustre is a perennial plant native to North America. The following description is taken from Olga Lakela’s reference *A Flora of Northeastern Minnesota*.

> *“Plants up to 7 dm tall, rhizomatous, from slender caudices, glabrate below, pubescent above; lower leaves 1.5 dm long; petioles and rachis narrowly margined; leaves narrowly elliptic or linear, glabrous; floral bract pinnate, the uppermost reduced to a few segments; peduncles and pedicels densely viscid pubescent, calyx short-campanulate with obtuse deltoid lobes becoming longer than the tube, glabrate at tips, densely pubescent below; corolla violet blue, with spreading lobes; stamens included: filaments dilated, declined, hair-tufted below; ovary with nectar gland; style filamentous with ascending stigmatic lobes, violet or edge with violet. Rare; Extension of a Western species. Flowers June to July.”*

Gray’s Manual of Botany includes:

> *“Slender and horizontally creeping rhizome; summit of stem viscid and pilose but without elongate glands; leaflets lance-linear, 2-7 mm; the lowest bracteal leaf with 9-13 leaflets; panicle more branching and open, with long ascending branches; calyx-lobes deltoid-oblong to –lanceolate, acutish,; corolla bright violet, strongly whitened at center. 1-1.5 cm high, Arbor-vitae swamp, St. Louis County, Minnesota. Flowers late June-early July – Eastern representative of a western species”.*

A separate subspecies of western Jacob’s ladder, *Polemonium occidentale* ssp. *occidentale*, is common and occurs in the mountains of western North America (Hitchcock and Cronquist 1973).

LIFE HISTORY AND ECOLOGY

Polemonium occidentale ssp. lacustre is a perennial that can reproduce by seed as well as vegetatively by short, unbranched rhizomes (Chadde 1998). This species flowers in late June to July with a peak in early July. Tiny seeds are borne in capsules that open after drying out (Newhouse 1993). This species is an obligate wetland species according to the U.S. Fish and Wildlife Service. Little else is known about the ecology or life history of this rare species.

HABITAT

Habitat requirements for *Polemonium occidentale* v. *lacustre* include open forested wetland communities with associated white cedar (*Thuja occidentalis*), tamarack (*Larix laricina*), black spruce (*Picea mariana*), and generally a ground cover of *Sphagnum* spp.

Collection data from the Minnesota Bell Herbarium specimens can be reviewed in Appendix I and relevant habitat data is shown in Table 1. The last specimen referenced in Table 1 was collected in the Superior National Forest.

Table 1. Habitat data for Minnesota Bell Herbarium Collections

Habitat	Associated Species
White Cedar Swamp, mostly in openings with water 6-12 inches below the surface;	*Coptis groenlandica, Mitella nuda, Cypripedium*
Wet peat soil, in the sun. Located in a bog	*Cypripedium parviflorum, Smilacina trifolia, C. hirsutum*
A colony ca. 1 acre in area, in a Arbor vitae swamp	N/A
Open canopy area of cedar bog	N/A
Shady woods along a small brook	*Laportea canadensis, Pteretis nodulosa, Myosotis*
Cedar/ Spruce/ Alder swamp	N/A
Small wet areas of black spruce, clearcut about 1989 * Collected in the Superior National Forest	*Cornus canadensis, Rhamnus alnifolia, Betula pumila, Caltha palustris, Potentilla palustris*

In Minnesota, Bruce Carlson and Nancy Sather (2003) describe other associated plants including: *Arethusa bulbosa, Cypripedium reginae, Cardamine pratensis var. palustris* and *Triglochin maritimum.* Soil pH levels are near neutral at all collection sites, and the water chemistry suggests groundwater up-welling (Carlson and Sather 2003).

Collection data from the Wisconsin State Herbarium can be reviewed in Appendix II, and relevant habitat data is shown in Table 2. Wisconsin has two populations, both occurring on the Chequamegon-Nicolet National Forest. The Herbarium records reference the collection of the first documented population. An additional population was located in 1991, approximately one mile from the first recorded population, but is not recorded in the Herbarium records. Craig Anderson, Botanist for the Wisconsin Natural Heritage Inventory program provided the habitat data that includes the 1991 collection.

Table 2. Habitat data-Wisconsin State Herbarium Wisconsin Natural Heritage Inventory

Habitat	Associated Species
Strip-cut Thuja swamp	Polemonium occidentale, Valeriana sitchensis, Carex gynocrates, C. tenuiflora.
Strip-cut Thuja swamp	Polemonium occidentale, Valeriana sitchensis, Carex gynocrates, C. tenuiflora. Common in S part of swamp.
*Northern Wet Forest - Cold, seeping calcareous conifer swamps.	Larix laricina, Thuja occidentalis, Picea mariana, Valeriana sitchensis subsp. uliginosa, Carex tenuiflora, C. gynocrates, C. lacustris, Saxifraga pensylvanica, Calla palustris, Equisetum fluviatile, Alnus rugosa.

STATUS, DISTRIBUTION, AND ABUNDANCE

This species only occurs in Minnesota and Wisconsin. The State and Province ranking for both Minnesota and Wisconsin is S1 – critically imperiled, and both states have listed *Polemonium occidentale* v. *lacustre* as endangered. It is listed as a Regional Forester's Sensitive Species on the Chequamegon-Nicolet and Superior National Forests. The Global Heritage Status Rank is listed as G5?T1Q. This rank is defined as follows:

- G5? – The taxon *Polemonium* occidentale is globally secure, although there is some uncertainty in this rank, as indicated by the "?", which means inexact rank
- T1Q – The subspecies lacustre is critically imperiled, although there are some questions about its taxonomy, which, when resolved, could result in a status change

According to the NatureServe Status Report, the Global Status is based on the limited number of populations of *Polemonium occidentale* v. *lacustre* that are known. Although the U.S. Fish and Wildlife Service placed the species under review in 1976 (as Federal Category 2), no formal action was taken and the Category 2 status was removed. (Anderson 1998) This species is not currently federally listed.

The Map references the State/Province Conservation Status Rank and shows the North American Distribution of *Polemonium occidentale* v. *lacustre*

State/Province Conservation Status Rank

- SX: Presumed Extirpated
- SH: Possibly Extirpated
- S1: Critically Imperiled
- S2: Imperiled
- S3: Vulnerable
- S4: Apparently Secure
- S5: Secure

- SR: Reported
- SZ: Migratory Transient
- SE: Exotic
- S?: Unranked
- Under Review
- SU: Unrankable

Available: http://www.natureserve.org/explorer

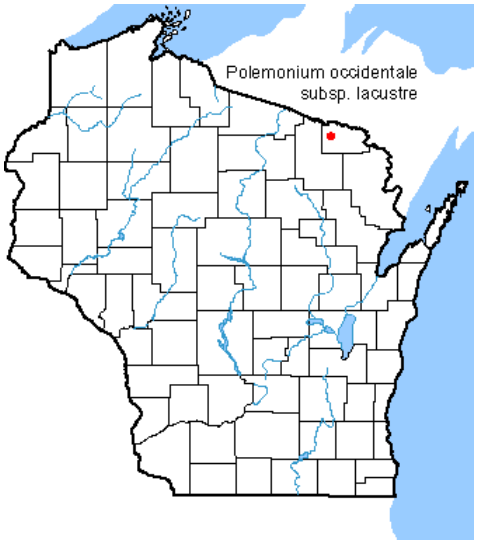
Minnesota distribution

Polemonium occidentale ssp. lacustre has been documented in St. Louis and Itasca Counties (Carlson and Sather 2003). Four existing populations are known in Minnesota with one recorded in the Superior National Forest. Bruce Carlson, Botanist with the DNR Natural Heritage and Non-game Research Program and Minnesota County Biological Survey, located the fourth population in Minnesota during the summer of 2001 in Itasca County.

Wisconsin Distribution

The Wisconsin Distribution map for *Polemonium occidentale* was shown at the Natural Resource Conservation Service Plant database website

(http://plants.usda.gov/cgi/topics.cgi). Two populations are documented in the State of Wisconsin, both occurring on the Chequamegon-Nicolet National Forest in Florence County. This species is not known to occur elsewhere in the Great Lakes region.



Polemonium occidentale ssp. lacustre Wisconsin Distribution – Florence County

VIABILITY AND POTENTIAL THREATS

Carlson and Sather (2003) review the history of the documented populations of *Polemonium occidentale ssp. lacustre* in a Minnesota County Biological Survey fact sheet entitled *Western Jacob's Ladder, A True Rarity*.
(http://www.dnr.state.mn.us/wildflowers/jacobsladder.html)
According to Carlson and Sather, the original species discovery occurred in 1944 when Olga Lakela, the curator of the University of Minnesota Duluth Herbarium, collected a specimen in St. Louis County, Minnesota. University of Minnesota herbarium records (see Appendix 1) reference an even earlier Lakela collection of July 11, 1937 from St. Louis County. There was no record of Carlson and Sather searching for this collection site or citing it. A second collection in 1946 by Lakela's student George Monson is documented in the herbarium records.

Searches conducted during the 1960's and 1970's didn't reveal the documented population from the 1940's. The species was proposed for federal listing as Endangered by the late 1980's, thus prompting the Minnesota Natural Heritage and Nongame Research program to increase survey efforts. In July of 1988, Nancy Sather found a population within a mile of Lakela's 1944 collection, but Lakela's original population has never been identified and is not considered one of the current four populations in the state of Minnesota.
In 1982, botanists in the Nicolet National Forest discovered *Polemonium occidentale* v. *lacustre*. Initially, there was speculation about possible seed translocation to the Nicolet site from western populations of *Polemonium occidentale* v. *occidentale* via wildland

firefighter's boots. This theory was dispelled in 1989 when samples were sent to Dr. Dieter Wilken, Director of Research Santa Barbara Botanic Garden, for verification. He affirmed the Minnesota and Wisconsin populations weren't differentiated, but the Midwest and the Western populations were. Extensive surveys were conducted in Minnesota and Wisconsin from 1992 – 1995 covering 73 potential sites over 10,000 acres of habitat. These efforts yielded three more populations, two in Minnesota, 15 miles east and 50 miles south of the original population, and a second population in Wisconsin, 1 mile from the original population.

Habitat data suggest that this species requires open forested wetland communities with associated white cedar. Likely threats would include increased canopy closure, any activity that directly alters the habitat and destroys plants (e.g. slash piles, peat mining, and flooding by beaver dams), or anything that alters groundwater flow (Anderson et al. 1998). All known locations of this species have a history of logging, ranging from early 1900's disturbance to as recent as the 1990's. In all six known populations, *Polemonium occidentale ssp. lacustre* is most common and blooms most in natural or logging-related openings (Carlson). In contrast to other species associated with Cedar communities, logging appears to be less of a threat. Carlson states that the relationship between logging and *Polemonium occidentale* v. *lacustre* has not been researched, but winter logging under frozen ground conditions may not be a serious threat to this species. Another land use that may have significant impact is peat mining, which would likely reduce or eliminate populations. The decline of *Thuja* swamps as a viable community and the high deer populations are also threats for this species where high density deer populations exist (Chequamegon-Nicolet and Ottawa), future influences of global warming may affect the ability of cedar communities to adapt to changing microclimatic conditions and to compete with communities shifting to the north [Fewless and Spickerman (pers. comm., April 2003)].

RESEARCH AND MONITORING

A genetic analysis was conducted on *Polemonium occidentale* v. *lacustre*, and results indicated an evolutionary history that resulted in differentiation from other *Polemonium* species. The data did not indicate if this study was based on morphological characteristics or isozymes, but results indicated that there is little genetic differentiation between populations of this species (Cole 1998). Anderson (1998) states that further genetic studies need to be carried out to confirm without a doubt that there is a genetic basis in addition to the morphological basis for treating this taxon as a distinct subspecies.

Polemonium occidentale v. *lacustre* is listed as endangered in both Minnesota and Wisconsin. All populations are located on public land, either in county, state, or federal land ownership, and are subject to no restrictive uses of the forest including timber production. Carlson suggests that forest harvesting activity may not be detrimental to the species as long as the harvests are winter cut, the hydrology of the site is not affected, and landing sites or logging slash is not adjacent to populations. Habitat data suggests that this species requires natural or artificial canopy openings in order to stimulate flower production and assure seed production. (Anderson et al. 1998). There is a need for future

research projects related to the impact of harvesting to determine the optimum conditions for maintaining viable populations of *Polemonium occidentale* v. *lacustre.*

Surveys within the Upper Peninsula of Michigan in similar habitats are being conducted by the US Forest Service to possibly identify additional populations [Trull (pers. comm., July 2003)]. Spickerman suggests possible research on *Polemonium* and why it's so restricted in range, yet is relatively abundant, flowering and seed producing, indicating viability on one site, but no presence on similar habitats nearby.

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APPENDIX I:

Collection data for seven *Polemonium occidentale* specimens from the Bell Herbariu**m**
Species data is presented as it appeared in the Herbarium records.

1. Location: St. Louis County * Sturgeon River State Forest Habitat: Extensive white cedar swamp; mostly in openings with water 6-12 inches below the surface; vegetative on drier or shaded sites. Associated species: *Coptis groenlandica, Mitella nuda, Cypripedium* Collector 1: Monson, Paul H. Collector Date: Sunday, July 2, 1989
2.Location: St. Louis County Habitat: Wet peat soil, in the sun. Located in a bog. With *Cypripedium parviflorum, Smilacina trifolia, C. hirsutum* Collector 1: Monson, George Collector Date: Sunday, June 30, 1946
3. Location: St. Louis County Habitat: A colony ca. 1 acre in area, in Arbor vitae swamp. Collector 1: Lakela, O. Collector Date: Sunday, July 2, 1944
4. Location: St. Louis County * Sturgeon River State Forest Habitat: Open canopy area of cedar bog Collector 1: Sather, N.P. Collector Date: Friday, July 8, 1988
5. . Location: St. Louis County Habitat: Shady woods along a small brook. With *Laportea canadensis, Pteretis nodulosa, Myosotis.* Collector 1: Lakela, O. Collector Date: Sunday, July 11, 1937
6. Location: St. Louis County Habitat: in a Cedar/ Spruce/ Alder swamp Collector 1: Dahle, R.M. Collector 2: Engels, A. Collector 3: Butler, Cindy Collector Date: Wednesday, July 28, 1999
7. Location: St. Louis County * Superior National Forest Habitat: Small wet areas of black spruce, clearcut about 1989. Assoc.: *Cornus canadensis, Rhamnus alnifolia, Betula pumila, Caltha palustris, Potentillapalustris* Collector 1: Lake, R. Collector Date: Saturday, June 29, 1991

APPENDIX II:

Collection data for three *Polemonium occidentale* specimens from the Wisconsin Herbarium
Species data is presented as it appeared in the Herbarium records.

1. Location: Florence County Habitat: Strip-cut *Thuja* swamp with *Polemonium occidentale, Valeriana sitchensis, Carex gynocrates, C. tenuiflora.* Collector: Judziewicz, Emmet J. Addl. Collectors: Solheim, S.L. Collector Date: 6/30/1983
2. Location: Florence County Habitat: Strip-cut *Thuja* swamp with *Polemonium occidentale, Valeriana sitchensis, Carex gynocrates, C. tenuiflora.* Collector: Judziewicz, Emmet J. Addl. Collectors: Solheim, S.L. Collector Date: 7/8/1982
3. Location: Florence County Habitat: Strip-cut *Thuja* swamp with *Polemonium occidentale, Valeriana sitchensis, Carex gynocrates, C. tenuiflora*. Common in S part of swamp. FIRST WIS RECORD Collector: Judziewicz, Emmet J Addl. Collectors: Solheim, S.L. Collector Date: 7/4/1982